

## CLAIMS

*We Claim:*

1. An average current estimation circuit comprising:
  - (a) a diode;
  - (b) a resistor in series with a switch, with the resistor coupled to a termination of the diode;
  - (c) an RC filter in parallel with the resistor and switch of element (b).
2. The average current estimation circuit of Claim 1 wherein the switch is synchronized with an incoming peak current signal.
3. The average current estimation circuit of Claim 1 wherein an average current signal is sensed across a capacitor in the RC filter.
4. The average current estimation circuit of Claim 1 wherein the RC filter smooths an average current signal.

- 1 5. A switch mode power supply comprising:  
2 (a) a peak current sensing circuit using a current sensing shunt; and  
3 (b) an average current estimation circuit.  
4
- 5 6. The switch mode power supply of Claim 5 wherein a peak current signal is sensed  
6 across the current sensing shunt.  
7
- 8 7. The switch mode power supply of Claim 5 wherein the average current estimation  
9 circuit comprises:  
10 (a) a diode;  
11 (b) a resistor in series with a switch, with the resistor coupled to a termination of  
12 the diode;  
13 (c) an RC filter in parallel with the resistor and switch of element (b).  
14
- 15 8. The switch mode power supply of Claim 7 wherein the switch is synchronized  
16 with an incoming peak current signal.  
17
- 18 9. The switch mode power supply of Claim 5 further comprises a power switch in  
19 series with the current sensing shunt.  
20
- 21 10. The switch mode power supply of Claim 9 wherein the switch in the average  
22 current estimation circuit is synchronized with the power switch.  
23
- 24 11. The average current estimation circuit of Claim 5 wherein an average current  
25 signal is sensed across a capacitor in the RC filter.  
26  
27

1 12. A switch mode power supply comprising :

2 (a) a peak current sensing circuit using a current sensing transformer; and

3 (b) an average current estimation circuit wherein (a) and (b) are in parallel.

4  
5 13. The switch mode power supply of Claim 12 wherein the peak current sensing  
6 circuit further comprises a diode and a shunt resistor in series with a secondary winding  
7 of the current sensing transformer.

8  
9 14. The switch mode power supply of Claim 13 wherein the peak current signal is  
10 sensed across the shunt resistor.

11  
12 15. The switch mode power supply of Claim 12 wherein the average current  
13 estimation circuit comprises:

14 (a) a diode;

15 (b) a resistor in series with a switch, with the resistor coupled to a termination of  
16 the diode;

17 (c) an RC filter in parallel with the resistor and switch of element (b).

18  
19 16. The switch mode power supply of Claim 15 wherein an average current signal is  
20 sensed across a capacitor of the RC filter.

21  
22 17. The switch mode power supply of Claim 12 wherein a switch in the average  
23 current estimation circuit is synchronized with an incoming current signal.



- 1     24.     A switch mode power supply comprising:
  - 2             (a) a peak current sensing circuit;
  - 3             (b) an average current estimation circuit;
  - 4             (c) a current sensing transformer wherein both the peak current sensing circuit
  - 5     and the average current estimation circuit are coupled to the current sensing transformer.
  - 6
- 7     25.     The switch mode power supply of Claim 24 wherein the current sensing
- 8     transformer has two secondary windings.
- 9
- 10    26.     The switch mode power supply of Claim 24 wherein a peak current signal and an
- 11    average current signal can be referenced to a first and a second ground.
- 12
- 13    27.     The switch mode power supply of Claim 24 wherein the peak current sensing
- 14    circuit further comprises a diode and a shunt resistor in series with a secondary winding
- 15    of the current sensing transformer.
- 16
- 17    28.     The switch mode power supply of Claim 27 wherein the peak current signal is
- 18    sensed across the shunt resistor.
- 19
- 20    29.     The switch mode power supply of Claim 24 wherein the average current
- 21    estimation circuit comprises:
  - 22             (a) a diode;
  - 23             (b) a resistor in series with a switch, with the resistor coupled to a termination of
  - 24     the diode;
  - 25             (c) an RC filter in parallel with the resistor and switch of element (b).
  - 26
- 27    30.     The switch mode power supply of Claim 24 wherein an average current signal is
- 28    sensed across a capacitor of the RC filter.
- 29
- 30    31.     The switch mode power supply of Claim 24 wherein a switch in the average
- 31    current estimation circuit is synchronized with an incoming current signal.

1 32. A switch mode power supply comprising

2 (a) a peak current sensing circuit;

3 (b) a average current estimation circuit; and

4 (c) an op-amp coupled to the output of the average current sensing circuit.

5  
6 33. The switch mode power supply of Claim 32 wherein the op-amp is configured as  
7 a non-inverting amplifier and is coupled to a diode between the negative input of the op-  
8 amp and the output of the op-amp.

9  
10 34. The switch mode power supply of Claim 32 wherein a resistor from a negative  
11 input of the op-amp and the ground.

12  
13 35. The switch mode power supply of Claim 32 wherein the op-amp offsets a voltage  
14 drop from a diode in the average current estimation circuit.